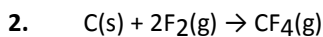
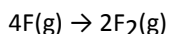


T05D06 – 5.4 IB Practice MS

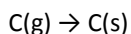
1. D



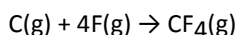
$\Delta H_1 = -680 \text{ kJ};$



$\Delta H_2 = 2(-158) \text{ kJ};$



$\Delta H_3 = -715 \text{ kJ};$

Accept reverse equations with +ΔH values.

$\Delta H = -1711 \text{ kJ},$

so average bond enthalpy = $\frac{-1711}{4}$

$= -428 \text{ kJ mol}^{-1};$

4

*Accept + or – sign.**Lots of ways to do this! The correct answer is very different from the value in the Data Booklet, so award [4] for final answer with/without sign units not needed, but deduct [1] if incorrect units. Accept answer in range of 427 to 428 without penalty for sig figs.**If final answer is not correct use following;**Award [1] for evidence of cycle or enthalpy diagram or adding of equations.**Award [1] for $2\text{F}_2\text{(g)} \rightarrow 4\text{F(g)}$ 2×158 seen.**Award [1] for dividing 1711 or other value by 4.*

[4]

3. (a) energy for the conversion of a gaseous molecule into (gaseous) atoms;
(average values) obtained from a number of similar bonds/compounds/OWTTE;
 $\text{CH}_4\text{(g)} \rightarrow \text{C(g)} + 4\text{H(g)};$

3

State symbols needed.

- (b) (bond breaking) = 1890/654;
(bond formation) = 2005/769;

enthalpy = $-115(\text{kJ mol}^{-1})$

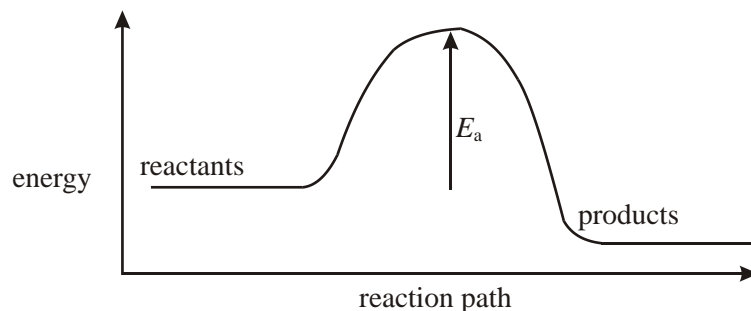
3

*Allow ECF from bond breaking and forming.**Award [3] for correct final answer.**Penalize [1] for correct answer with wrong sign.*

- (c) molecules have insufficient energy to react (at room temperature)/
wrong collision geometry/unsuccessful collisions;
extra energy needed to overcome the activation energy/ E_a for the reaction;

2

(d)



exothermic shown;
activation energy/ E_a shown;

2

Allow ECF from (b).

[10]

4. (a) exothermic because temperature rises/heat is released;
(b) to make any heat loss as small as possible/so that all the heat will be given out very quickly;

1

1

Do not accept "to produce a faster reaction".

- (c) heat released = mass \times specific heat capacity \times temp increase/ $q = mc\Delta T =$
 $100 \times 4.18 \times 3.5;$
 $= 1463 \text{ J}/1.463 \text{ kJ};$ (allow 1.47 kJ if specific heat = 4.2)
amount of KOH/HCl used = $0.500 \times 0.050 = 0.025 \text{ mol};$

$\Delta H = (1.463 \div 0.025) = -58.5 (\text{kJ mol}^{-1});$ (minus sign needed for mark)

4

Use ECF for values of q and amount used.

Award [4] for correct final answer.

Final answer of 58.5 or +58.5 scores [3].

Accept 2,3 or 4 significant figures.

- (d) heat loss (to the surroundings);
insulate the reaction vessel/use a lid/draw a temperature versus time graph; 2
- (e) 3.5°C/temperature change would be the same;
amount of base reacted would be the same/excess acid would not react/
KOH is the limiting reagent; 2
5. (a) (i) $\text{C}_2\text{H}_4(\text{g}) + \text{H}_2(\text{g}) \rightarrow \text{C}_2\text{H}_6(\text{g})$; 1
State symbols not required for mark
- (ii) products more stable than reactants/reactants less stable than products;
products lower in energy/reactants higher in energy; 2
- (iii) (overall) bonds in reactants weaker/(overall) bonds in product stronger
/all bonds in product are ☐bonds/weaker ☐bond broken and a
(stronger) ☐bond formed;
less energy needed to break weaker bonds/more energy produced
to make stronger bonds (thus reaction is exothermic)/OWTTE;
OR
bond breaking is endothermic/requires energy and bond making is
exothermic/releases energy;
stronger bonds in product mean process is exothermic overall; 2
6. (a) (i) standard enthalpy (change) of reaction;
(temperature) increase;
reaction is exothermic/sign of ΔH^\ominus is negative; 3
- (ii) more (negative);
heat given out when gas changes to solid/solid has less enthalpy than
gas/OWTTE; 2
- (iii) -389 kJ; 1
7. (a) (Amount of energy required to break bonds of reactants)
 $8 \times 412 + 2 \times 348 + 612 + 6 \times 496 / 7580 \text{ (kJ mol}^{-1}\text{)}$;
(Amount of energy released during bond formation)
 $4 \times 2 \times 743 + 4 \times 2 \times 463 / 9648 \text{ (kJ mol}^{-1}\text{)}$;
 $\Delta H = -2068 \text{ (kJ or kJ mol}^{-1}\text{)}$; 3
ECF from above answers.
Correct answer scores [3].
Award [2] for (+)2068.
If any other units apply [1](U), but only once per paper.
- (b) exothermic and ΔH^\ominus is negative/energy is released; 1
Apply ECF to sign of answer in part (a).
Do not mark if no answer to (a).

[10]

[5]

[6]

[4]